Activity: **6.7**
Develop System Design

Responsibility: Project Team

Description: The system design is the main technical work product of the System Design Stage. The system design translates requirements into precise descriptions of the software components, interfaces, and data necessary before coding and testing can begin. It is a blueprint for the Programming Stage, based on the software structure and data model established in the Functional Design Stage.

The system design plays a pivotal role in the development and maintenance of a software product. The design provides valuable information used by the project manager, quality assurance staff, configuration management staff, software designers, programmers, testers, and maintenance personnel.

The system design is baselined after the system owner's formal approval of the design as described in the System Design Document. Once the system design is baselined, any changes to the design must be managed under change control procedures established in the Software Configuration Management Plan. Approved changes must be incorporated into the System Design Document.

It is important for the system owner/users to understand that some changes to the baselined system design may affect the project scope and therefore can change the project cost, resources, or schedule. It is the responsibility of the project manager and team to identify system owner/user requested changes that would result in a change of project scope; evaluate the potential impact to the project costs, resources, or schedule; and notify the system owner of the project planning revisions that will be required to accommodate their change requests.

Work Product: Each requirement identified in the Software Requirements Specification must be traceable to one or more design entities. This traceability ensures that the software product will satisfy all of the requirements and will not include inappropriate or extraneous functionality. Expand the Requirements Traceability Matrix developed in the Requirements Definition Stage to relate the system design to the requirements. Place a copy of the expanded matrix in the Project File. Refer to each task for other applicable work products.

Review Process: Conduct a structured walkthrough of the Requirements Traceability Matrix.

Refer to task 6.7.2, *Conduct Critical Design Review*, for the system design review process.

Tasks: The following tasks are involved in developing the system design.

6.7.1 Develop System Design Document

6.7.2 Conduct Critical Design Review

Task: **6.7.1**
Develop System Design Document

Description: The System Design Document records the results of the system design process and describes how the software product will be structured to satisfy the requirements identified in the Software Requirements Specification. The System Design Document is a translation of the requirements into a description of the software structure, software components, interfaces, and data necessary to support the programming process.

Work Product: Prepare the System Design Document and submit it to the system owner and users for their review and approval. The approved System Design Document is the official agreement and authorization to use the design to build the software product. Approval implies that the design is understood, complete, accurate, and ready to be used as the basis for the subsequent lifecycle stages. In other words, once approved this becomes the design baseline. Subsequent changes or additions to the software design that receive stakeholder concurrence supersede the existing baseline and establish a new design baseline. Place a copy of the approved System Design Document in the Project File.

Review Process: Conduct structured walkthroughs as needed to ensure that the System Design Document is accurate and complete.

The completion of the System Design Document is an appropriate time to schedule an In-Stage Assessment (ISA).

Reference: The *In-Stage Assessment Process Guide* provides a description and instructions for conducting an ISA. A copy of the guide is provided in Appendix D.

Resource: A System Design Document template is available on the Software Management Program Web site.

Task: **6.7.2**
Conduct Critical Design Review

Description: The Critical Design Review is a formal technical review of the system design. The purpose of the review is to demonstrate to the system owner and users that the system design can be implemented on the selected platform and accounts for all software and data requirements and accommodates all design constraints (e.g., performance, interface, security, safety, resource, and reliability requirements). The design review should include a review of the validity of algorithms needed to perform critical functions.

Several short Critical Design Reviews can replace one long review if the software consists of several components that are not highly interdependent. The review process should be a series of presentations by the project team to the system owner and other approval authorities.

Conduct a Critical Design Review that demonstrates that the design specifications are capable of supporting the full functionality of the software product, as follows:

- All algorithms will perform the required functions.
- The specification is complete, unambiguous and well documented, including timing and sizing, and data and storage allocations.
- The specification is necessary and sufficient for, and directly traceable to, the software system design.
- The specification is compatible with every other specification, piece of equipment, facility, and item of system architecture, especially as regards information flow, control, and sequencing.
- The specification is consistent with the abilities of current development and user personnel.

In addition to verifying individual specifications, the Critical Design Review assesses other project work products to ensure the following.

- The approved design approach is being followed by the team.
- Measures to reduce risk on a technical, cost, and schedule basis are adequate.

Description, continued:

- The performance characteristics of the design solution are acceptable.
- Testing will be sufficient to ensure software product correctness.
- The resultant application will be maintainable.
- Provisions for automatic, semi-automatic, and manual recovery from hardware/software failures and malfunctions are adequate and documented.
- Diagnostic programs, support equipment, and commercial manuals all comply with the system maintenance concept and specification requirements.

Work Product: Create and distribute official meeting minutes for each design review session. The minutes should consist of significant questions and answers, action items and individual/group responsible, deviations, conclusions, and recommended courses of action resulting from presentations or discussions. Recommendations that are not accepted should be recorded along with the reason for non-acceptance. Minutes must be distributed to review participants. The system owner determines review performance as follows:

- Approval - The review was satisfactorily completed.
- Contingent Approval - The review is not finished until the satisfactory completion of resultant action items.
- Disapproval - The specification is inadequate. Another Critical Design Review will be required.

Review Process: Not applicable.

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